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SECTION 620 - GEOTEXTILES

620.01 Description This work shall consist of the furnishing and installing of woven geotextile fabric or nonwoven geotechnical fabric, hereinafter called fabric, as shown in the Contract, or otherwise directed. This Section is intended for use in conjunction with Section 722 - Geotextiles.

620.02 Materials Geotextiles shall meet the requirements in the following Sections of Division 700 - Materials:

Stabilization/Reinforcement Geotextile	722.01
Drainage Geotextile	722.02
Erosion Control Geotextile	722.03
Separation Geotextile	722.04

620.03 Placement

a. Stabilization/Reinforcement and Separation Geotextile The installation site shall be prepared by clearing, grubbing, and excavating or filling the area to the design grade. This includes the removal of topsoil and vegetation. Soft spots and unsuitable areas identified during site preparation shall be excavated and backfilled with select material and compacted using normal procedures, as directed.

The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic. The subbase shall be placed by end dumping onto the geotextile from the edge of the geotextile, or over previously placed Subbase aggregate. Construction vehicles shall not be allowed directly on the geotextile. The subbase shall be placed such that at least the minimum specified lift thickness shall be between the geotextile and equipment tires or tracks at all times. Turning of vehicles shall not be permitted on the first lift above the geotextile. Any ruts occurring during construction shall be filled with additional subbase material and compacted to the specified density. In stabilization applications, the use of vibratory compaction equipment is not recommended with the initial lift of subbase as it may cause damage to the geotextile.

When fabric is to be used as a reinforcement geotextile, care shall be taken to tension the fabric before completely covering with aggregate. Cover material shall be placed starting on one edge of the fabric and progress toward the opposite edge, in order to maintain tension in the fabric.

When sloped riprap is to be placed on fabric, the site shall be prepared to provide an undulating and uneven surface, as much as is practical. The fabric shall be placed loosely to prevent any bridging of the uneven surface. Fabric to be placed on slopes shall have the long direction oriented up and down the slope as shown on the Standard Detail.

All joints between adjacent fabric roll ends that may occur on the slope shall be overlapped shingle style. The armor system placement shall begin at the toe and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. Riprap and heavy stone fill shall not be dropped from a height of more than 300 mm [1 ft]. Stone with a mass of more than 100 kg [220 lb] shall not be allowed to roll down the slope. Slope protection and smaller sizes of stone filling shall not be dropped from a height exceeding 1 m [3 ft], or a demonstration provided showing that the placement procedures will not damage the geotextile. Following placement of the armor stone, grading of the slope shall not be permitted if the grading results in movement of the stone directly above the geotextile.

For Separation Geotextile, when the fabric is to be placed in the roadway, the cover material shall be dumped on previously placed cover material or at the edges of the fabric and then pushed onto the fabric. The first layer of cover material shall be greater than 200 mm [8 in] and first compacted by a track bulldozer. At no time shall construction equipment be allowed on the fabric when the fabric is covered with less than 200 mm [8 in] of compacted cover material. Ruts shall be filled with additional cover material to maintain the minimum 200 mm [8 in] cover over the fabric. When fabric is placed in the roadway, the fabric roll widths shall be chosen so that there will be a minimum number of overlaps of parallel rolls. The total width of surface covered is shown on the Standard Details

b. Drainage Geotextile Trench excavation shall be done in accordance with details of the project plans. In all instances excavation shall be done in such a way as to prevent large voids from occurring in the sides and bottom of the trench. The graded surface

shall be smooth and free of debris. The fabric shall be placed loosely with no wrinkles or folds and with no void spaces between the geotextile and the ground surface.

Placement of the drainage aggregate should proceed immediately following placement of the geotextile. The geotextile shall be covered with a minimum of 300 mm [1 ft] of loosely placed aggregate prior to compaction. If a perforated collector pipe is to be installed in the trench, a bedding layer of drainage aggregate should be placed below the pipe, with the remainder of the aggregate placed to the minimum required construction depth. The aggregate should be compacted with vibratory equipment to a minimum of 95% Standard AASHTO density unless the trench is required for structural support. If higher compactive effort is required, a Class 1 geotextile as described in Section 722.03 - Geotextiles is needed.

c. Non-Woven Geotextile Non-woven Erosion Control Geotextiles require Class 2 geotextile class designation. All other Non-woven Geotextiles require Class 1 geotextile class designation.

The Non-woven Geotextile class selection is appropriate for conditions of equal or less severity than either of the following:

1. Armor layer stone weights do not exceed 100 kg [220 lb], stone drop height is less than 1 m (3 feet), and no aggregate bedding layer is required.

2. Armor layer stone weighs more than 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and the geotextile is protected by a 150 mm [6 in] thick aggregate bedding layer designed to be compatible with the armor layer. More severe applications require an assessment of geotextile survivability based on a field trial section and may require a geotextile of higher strength properties.

The Resident may specify a Class 2 geotextile based on one or more of the following:

a. The Resident has found Class 2 geotextiles to have sufficient survivability based on field performance of the geotextile.

b. The Resident has found Class 2 geotextiles to have sufficient survivability based on laboratory testing and visual inspection of a geotextile sample removed from a field test section constructed under anticipated field conditions.

c. Armor layer stone weighs less than 100 kg [220 lb], stone drop height is less than 1 m [3 ft], and the geotextile is protected by a 150 mm [6 in] thick aggregate bedding layer designed to be compatible with the armor layer.

d. Armor layer stone weights do not exceed 100 kg [220 lb] and stone is placed with a zero drop height. Note: 703.25 Stone Fill has stones up to 225 kg [500 lb], 703.26 Plain and Hand Held Riprap has stones up to 100 kg [220 lbs, 703.27 Stone blanket has stones up to 1,500 kg [3,300 lb], 703.28 Heavy Riprap has stones up to 450 kg [990 lb]

The geotextile shall be placed in intimate contact with the soils without wrinkles or folds and anchored on a smooth graded surface approved by the Resident. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch the geotextile, tearing it.

Anchoring of the terminal ends of the geotextile shall be accomplished using key trenches or aprons at the crest and toe of slope. The geotextile shall be placed with the machine direction parallel to the direction of water flow which is normally parallel to the slope of erosion control runoff and wave action and parallel to the stream or channel in the case of stream bank and channel protection. When riprap or stone ditch protection is placed on fabric, the stones shall be placed so that they do not puncture or otherwise damage the fabric.

When sloped riprap is to be placed on fabric, the site shall be prepared to provide an undulating and uneven surface, as much as is practical. The fabric shall be placed loosely to prevent any bridging of the uneven surface. Fabric to be placed on slopes shall have the long direction oriented up and down the slope as shown in the Standard Details.

All joints between adjacent fabric roll ends that may occur on the slope shall be overlapped shingle style. The armor system placement shall begin at the toe and proceed up the slope. Placement shall take place so as to avoid stretching and subsequent tearing of the geotextile. Riprap and heavy stone fill shall not be dropped from a height of more than 300 mm [1 ft]. Stone with a mass of more than 100 kg [220 lb] shall not be allowed to roll down the slope. Slope protection and smaller sizes of stone filling shall not be dropped from a height exceeding 1 m [3 ft], or a demonstration provided showing that the placement procedures will not damage the geotextile. Following placement of the armor

stone, grading of the slope shall not be permitted if the grading results in movement of the stone directly above the geotextile.

In underwater applications, the geotextile and backfill material shall be placed the same day. All void spaces in the armor stone shall be backfilled with small stone to ensure full coverage.

620.04 Overlap and Seams Adjacent lengths of fabric shall be joined by overlapping a minimum of 450 mm [18 in] at the ends and sides except when sewing is specified or fabric is placed on slopes. All overlaps on slopes shall be placed as follows:

a. For slopes steeper than 1 vertical to 3 horizontal: Sewn seams or minimum 1 m [3 ft] overlaps with no pinning or staking allowed.

b. For slopes flatter than 1 vertical to 3 horizontal: Sewn seams or minimum 450 mm [18 in] overlaps and pins or stakes may be used to anchor the overlaps per the manufacturer’s recommended spacing.

c. Overlaps shall be in the direction of flow.

When fabric is placed in the roadway, the fabric roll widths shall be chosen so that there will be a minimum number of overlaps of parallel rolls. The total width of surface covered is shown on the Standard Details.

When sewn seams are to be used, field or factory seaming by machine will be allowed. If a sewn seam is to be used for the seaming of the geotextile, the thread used shall consist of high strength Kevlar aramid, polyethylene, polyester, or polypropylene and shall have the same or greater durability as the geosynthetic being seamed. Nylon thread shall not be used. The thread shall be adjusted in the field to be sufficiently tight but not cut the geotextile. For Erosion Control applications, the thread shall also be resistant to ultraviolet radiation. The thread shall be of contrasting color to that of the geotextile itself. Flat/prayer seams or J-/Double J-type seams shall be used with double-locked stitches (Class 40l), except the "flat" seam may be used for repair of damaged in-place fabric. A stitch density of 200 to 400 stitches per meter shall be used for lighter-weight geotextiles while heavier geotextiles shall have 150 to 200 stitches per meter. All field seams shall be double stitched with two parallel passes and the 2 rows of stitching shall be approximately 13 mm [½ in] apart and shall not cross at any point. All stitching

shall be at least 25 mm [1 in] from the fabric edge.

For seams that are sewn in the field, the Contractor shall provide at least a 2 m [6.5 ft] length of sewn seam for sampling by the Resident before the geotextile is installed. For seams that are sewn in the factory, the Resident shall obtain samples of the factory seams at random from any roll of geotextile that is used on the project. For seams that are field sewn, the seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams. If seams are sewn in both the machine and cross machine direction, samples of seams from both directions shall be provided. The Contractor shall submit the seam assembly description along with the sample of the seam. The description shall include the seam type, stitch type, sewing thread, and stitch density. To facilitate inspection all seams shall be placed with the seam up so that repairs can easily be made if faulty seams are encountered during inspection, as shown on the Standard Detail. Procedures for testing sewn seams are given in ASTM D 4884 - Standard Test Method for Seam Strength of Sewn Geotextiles.

a. Stabilization/Reinforcement and Separation Geotextile Adjacent geotextile rolls shall be overlapped, sewn, or joined as required in the plans. Overlaps shall be in the direction shown on the plans. On curves the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock. The following Table summarizes the minimum overlap for geotextiles in this application:

AASHTO Classification	Minimum Overlap
A-1, A-2, A-3, A-4	450 mm [18 in]
A-5, A-6, A-7	1 m [3 ft] or sewn[a]
All roll ends	1 m [3 ft] or sewn[a]
[a]Seems shall be sewn when the soils have a CBR equal to or less than 1, unless otherwise specified.	

b. Drainage Geotextile Successive sheets of geotextiles shall be overlapped a minimum of 300 mm [1 ft], with the upstream sheet overlapping the downstream sheet. In trenches equal to or greater than 300 mm [1 ft] in width, after placing the drainage aggregate the geotextile shall be folded over the top of the backfill material in a manner to produce a minimum overlap of 300 mm [1 ft]. In trenches of less than 300 mm [1 ft] but greater than 100 mm [4 in] wide, the overlap shall be equal to the width

of the trench. Where the trench is less than 100 mm [4 in] the geotextile overlap shall be sewn or otherwise bonded. All seams shall be subject to the approval of the Resident.

c. Erosion Control Geotextile Adjacent geotextile sheets shall be joined by either sewing or overlapping. Overlapped seams of roll ends shall be a minimum of 450 mm [18 in] except where placed under water. In such instances the overlap shall be a minimum of 1 m [3 ft]. Overlaps of adjacent rolls shall be a minimum of 450 mm [18 in] in all instances. When overlapping, successive sheets of the geotextile shall be overlapped upstream over downstream, and/or upslope over downslope. In cases where wave action or multidirectional flow is anticipated, all seams perpendicular to the direction of flow shall be sewn. For Erosion Control applications, the thread shall also be resistant to ultraviolet radiation.

620.05 Certification The Contractor shall provide to the Resident a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns and other pertinent information to fully describe the geotextile. This information shall be furnished to the Resident for approval of the fabric before installation. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of Section 722 - Geotextiles. Documentation describing the quality control program shall be made available upon request. The Manufacturer's certificate shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the Manufacturer's quality control program. A person having legal authority to bind the Manufacturer shall attest to the certificate. Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

620.06 Sampling and Acceptance Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with the most current ASTM D4354, using the section titled, "Procedure for Sampling for Purchaser's Specification Conformance Testing." In the absence of purchaser's testing, verification may be based on manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer's Quality Assurance (MQA) Testing. A lot size for conformance or quality assurance sampling shall be considered the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

Testing shall be performed in accordance with the methods referenced in Section 722 - Geotextiles for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV. Refer to ASTM D4759 for more details regarding geotextile acceptance procedures.

620.07 Shipment, Storage, Protection, and Repair of Fabric Geotextile labeling, shipment and storage shall follow ASTM D4873. Product labels shall clearly show the manufacturer or supplier name, style number, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 71°C [160°F], and any other environmental condition that may damage the physical property values of the geotextile.

To prevent damaging the fabric, the Contractor shall exercise necessary care while transporting, storing, and installing the fabric. Atmospheric exposure of geotextiles to the elements following laydown shall be a maximum of 5 days to minimize damage potential. At no time shall riprap stones be rolled down the slope where fabric has been placed.

Before installation, the fabric shall be protected from rain, from sunlight or other ultraviolet exposure and from dust, mud, debris, or other elements that may affect its performance. Fabric that is torn, punctured, or otherwise damaged shall not be placed. During installation, direct weather exposure of the fabric shall be limited to a maximum of 5 days, from laydown to covering of the fabric.

a. Stabilization/Reinforcement Geotextile Before covering, the geotextile shall be inspected by the Resident to ensure that the geotextile has not been damaged during installation. Damaged geotextiles shall be repaired immediately. Cover the damaged area with a geotextile patch that extends an amount equal to the required overlap beyond the damaged area. If placement of the backfill material causes damage to the

geotextile, the damaged area shall be repaired as previously described. The placement procedure shall then be modified to eliminate further damage from taking place.

b. Drainage Geotextile Should the geotextile be damaged during installation or drainage aggregate placement, a geotextile patch shall be placed extending beyond the damaged area by a distance of 450 mm [18 in], or the specified seam overlap, whichever is greater.

c. Erosion Control Geotextile The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch the geotextile, tearing it. Care shall be taken during installation so as to avoid damage occurring to the geotextile as a result of the installation process. Should the geotextile be damaged during installation, a geotextile patch shall be placed over the damaged area extending 1 m [3 ft] beyond the perimeter of the damage. When riprap or stone ditch protection is placed on fabric, the stones shall be placed so that they do not puncture or otherwise damage the fabric. Field monitoring shall be performed to verify that the armor system placement does not damage the geotextile. Any geotextile damaged during backfill placement shall be replaced as directed by the Resident at the Contractor's expense.

620.08 Method of Measurement The quantity of geotextile will be measured by the number of square meters [square yards] of surface area covered and in direct contact with the cover material. Measurement will not be made for overlaps, patches and repairs of damaged geotextile unless additional overlap width is required by the Resident in which case measurement will be made for that added overlap area.

620.09 Basis of Payment Geotextiles will be paid for at the contract unit price per square meter [square yard]. Such payment shall be full compensation for furnishing and placing geotextile fabric; for all required surface preparation; for all labor, tools, materials and equipment; for repairing torn and damaged geotextile; and when required, for sewing seams and for furnishing and placing all pins or stakes or other hold down devices; for excavation for and furnishing and placing protective aggregate cushion; and for all other incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit

620.54	Stabilization/Reinforcement Geotextile	square meter [Square Yard]
620.55	Stabilization/Reinforcement Geotextile (sewn seams)	square meter [Square Yard]
620.56	Drainage Geotextile	square meter [Square Yard]
620.57	Drainage Geotextile (sewn seams)	square meter [Square Yard]
620.58	Non-woven Geotextile	square meter [Square Yard]
620.59	Non-woven Geotextile (sewn seams)	square meter [Square Yard]
620.60	Separation Geotextile	square meter [Square Yard]
620.61	Separation Geotextile (sewn seams)	square meter [Square Yard]

SECTION 621 - LANDSCAPING

621.0001 Description This work shall consist of the Contractor furnishing and planting trees, shrubs, vines, and other plants and shall include all planting operations and material as well as the care and replacement of the plants during the establishment period, all in accordance with the specifications, planting plans and schedules and the directions of the Resident. Planting operations will be divided into two classes.

a. Class A Planting will consist of planting into the existing soil that has been amended with organic humus.

b. Class B Planting will consists of planting into the existing soil without amendments.

Unless otherwise specified, all planting shall be Class A.

621.0002 Materials - General All non-planting material shall conform to the requirements specified in the following Sections of Division 700 - Materials.